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**Lurey et al.**

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(54) **SYSTEM AND METHOD FOR CHAT  
MESSAGING IN A ZERO-KNOWLEDGE  
VAULT ARCHITECTURE**

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(\*) Notice: Subject to any disclaimer, the term of this  
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U.S.C. 154(b) by 318 days.

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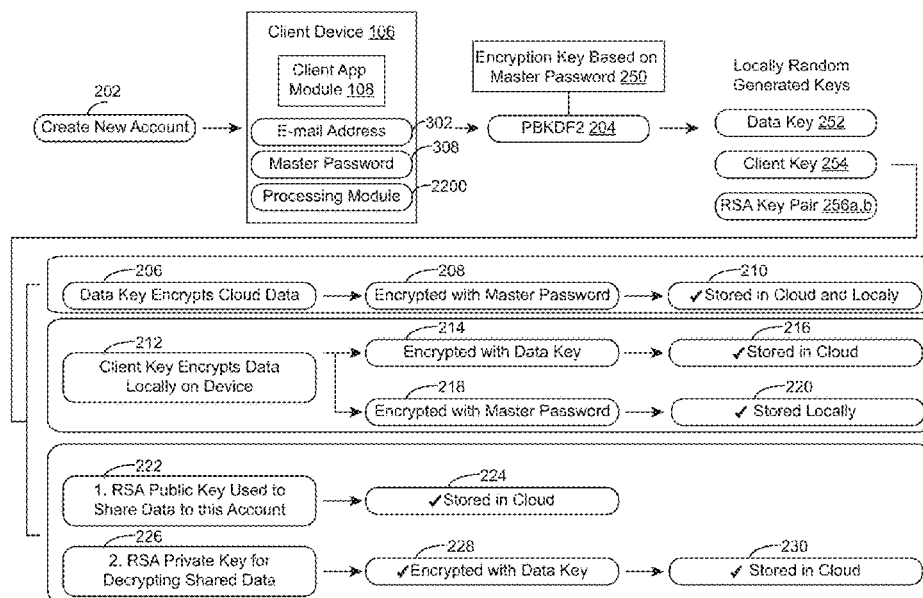
**ABSTRACT**

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**H04L 29/06** (2006.01)  
**H04L 12/58** (2006.01)  
**H04L 9/32** (2006.01)  
**H04L 9/08** (2006.01)  
(52) **U.S. Cl.**  
CPC ..... **H04L 63/0428** (2013.01); **H04L 9/0894**  
(2013.01); **H04L 9/3218** (2013.01); **H04L**  
**51/04** (2013.01); **H04L 51/16** (2013.01); **H04L**  
**2463/121** (2013.01)

(57) A system and/or method includes facilitating secured chat  
messaging. An application module can derive a master  
password-based encryption key from a master password.  
The application module can generate a data key and encrypt  
the data key with the master password-based encryption key.  
The application module can generate a record key for  
encrypting chat messages of a chat thread and encrypt the  
record key with the data key. The application module can  
decrypt the chat messages in the chat thread with the record  
key, where the record key is decrypted with the data key, and  
where the data key is decrypted with the master password-  
based encryption key. The application module can display  
the decrypted chat messages.

(58) **Field of Classification Search**  
CPC ..... H04L 9/14; H04L 63/045  
See application file for complete search history.

**17 Claims, 24 Drawing Sheets**



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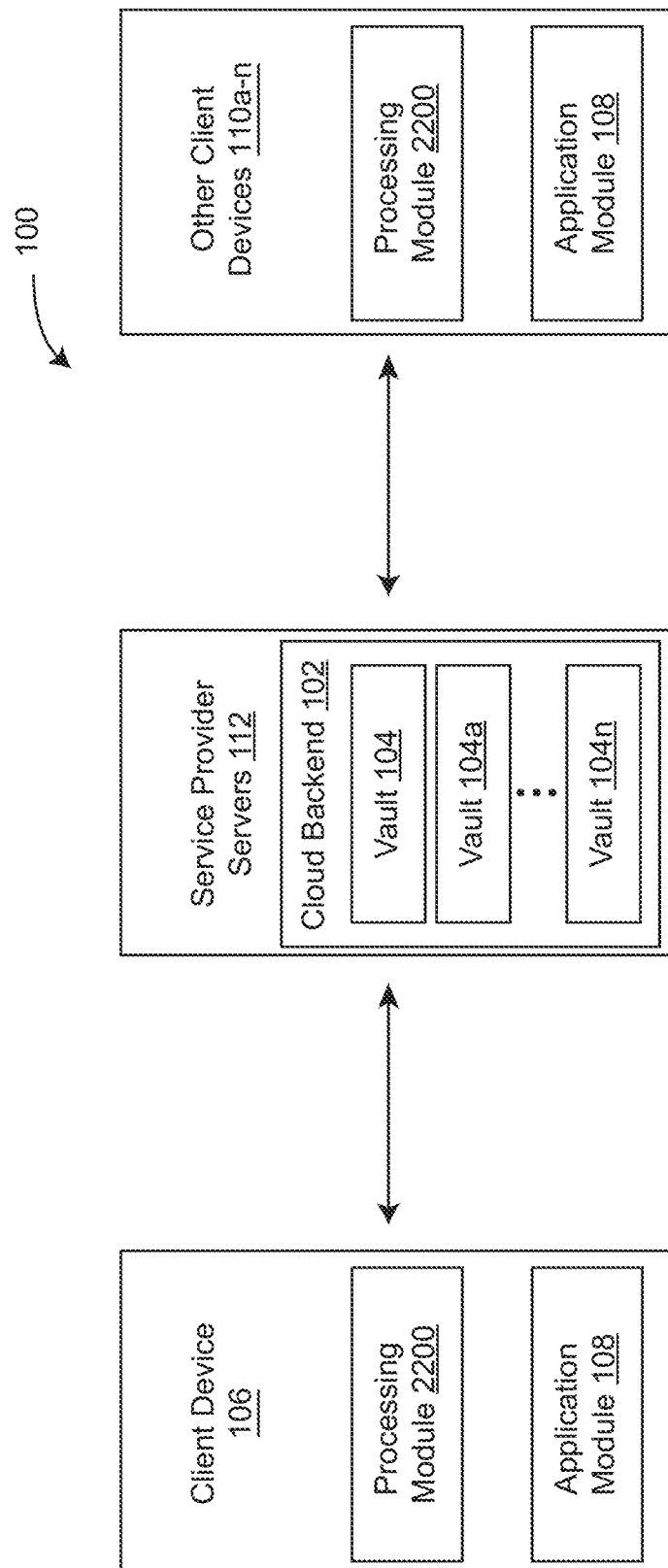
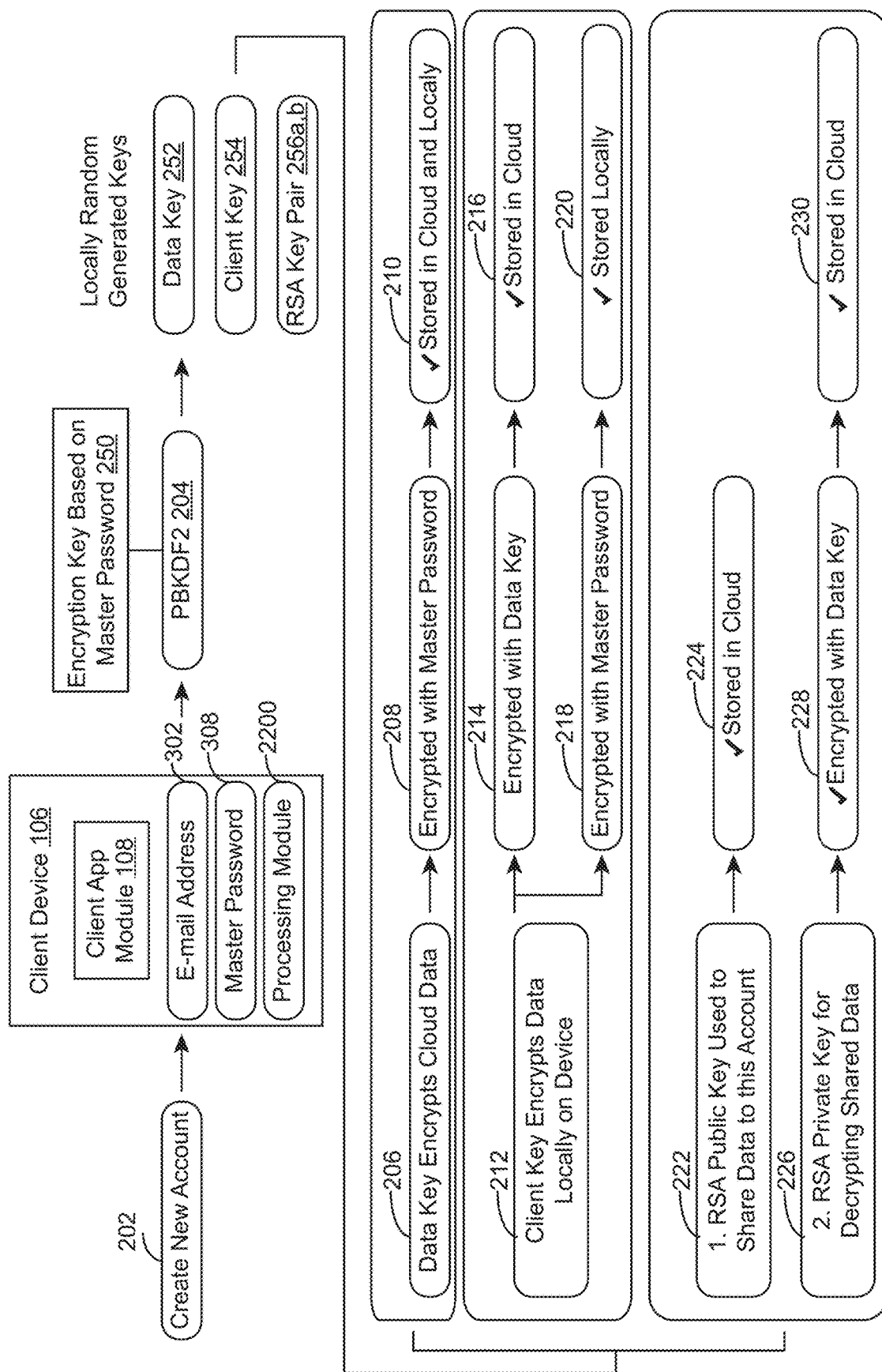


FIG. 1



264

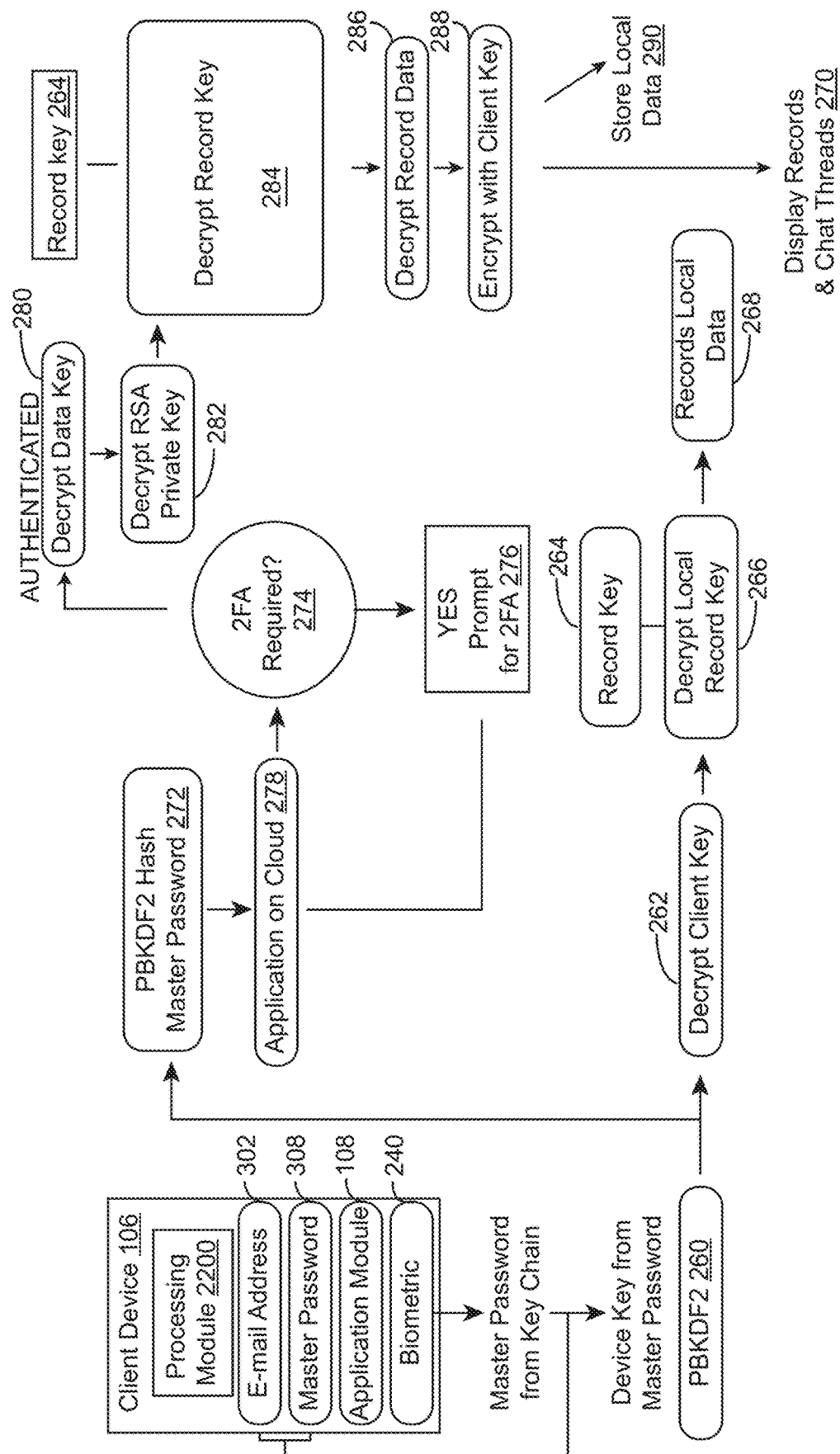


FIG. 3

300

1. E-mail Fields (Detects New/Existing)	2. Enter E-mail Address	3. Service Provider Determines New Fields Below	4. Enter Field Information
<p>keeperchat Welcome</p> <p>302</p> <p>Enter Your Email Address</p>	<p>keeperchat Welcome</p> <p>304</p> <p>user123@gmail.com</p>	<p>keeperchat Super Fast Signup</p> <p>306</p> <p>Enter Your Email Address</p> <p>308</p> <p>myPr@55wdrD123r0nG</p> <p>The only password you need to remember.</p> <p>United States +1</p> <p>309</p> <p>847-521-1346</p> <p>We'll text you a recovery code. Enter recovery code.</p> <p>310</p>	<p>keeperchat Super Fast Signup</p> <p>308</p> <p>Sarah@claspire</p> <p>303</p> <p>q w e r t y u i o p a s d f g h j k l z x c v b n m [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]</p>

FIG. 4A

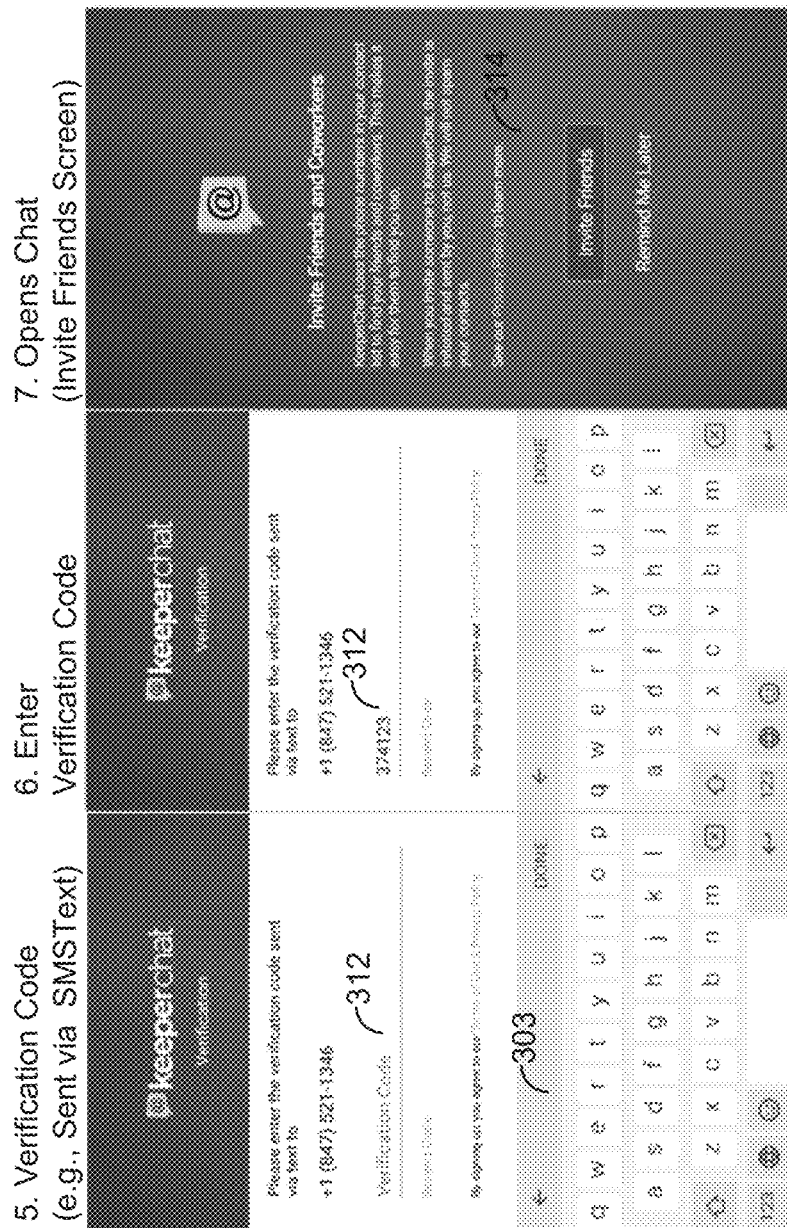


FIG. 4B

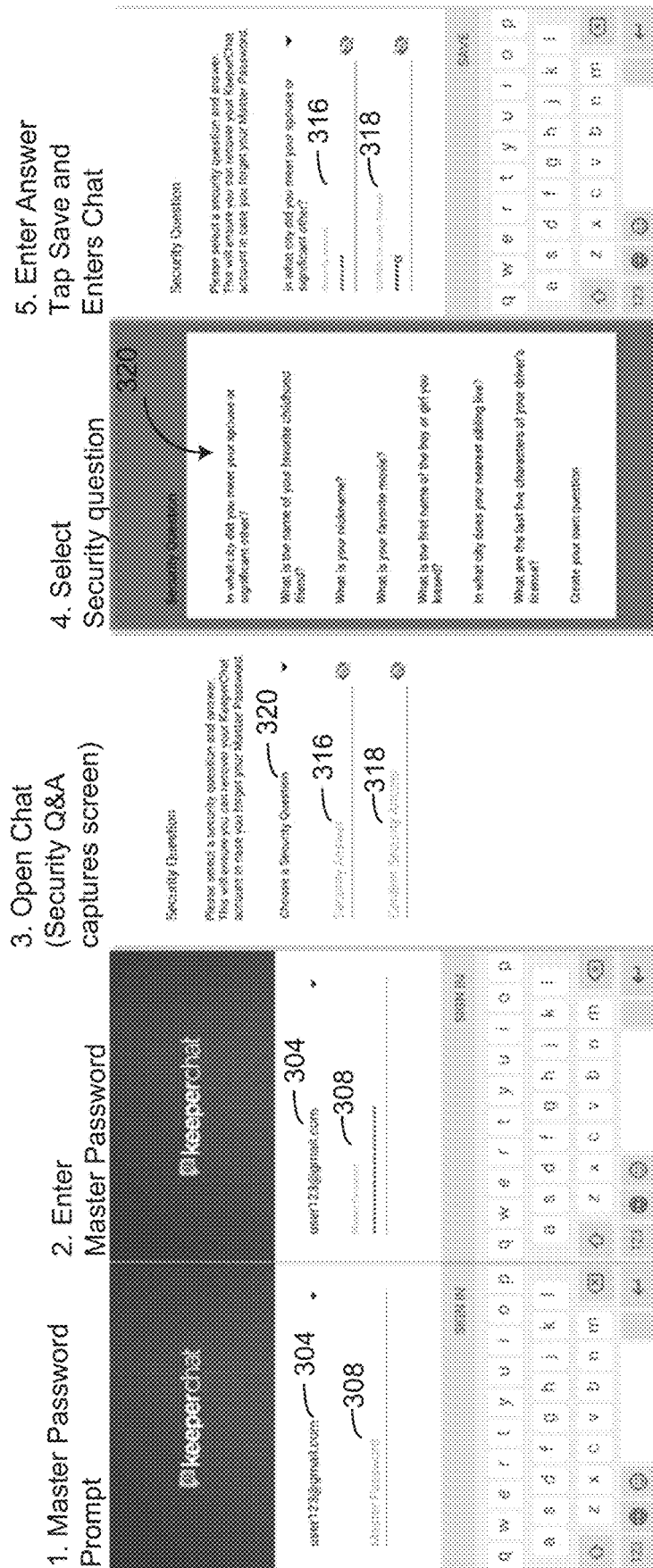


FIG. 5



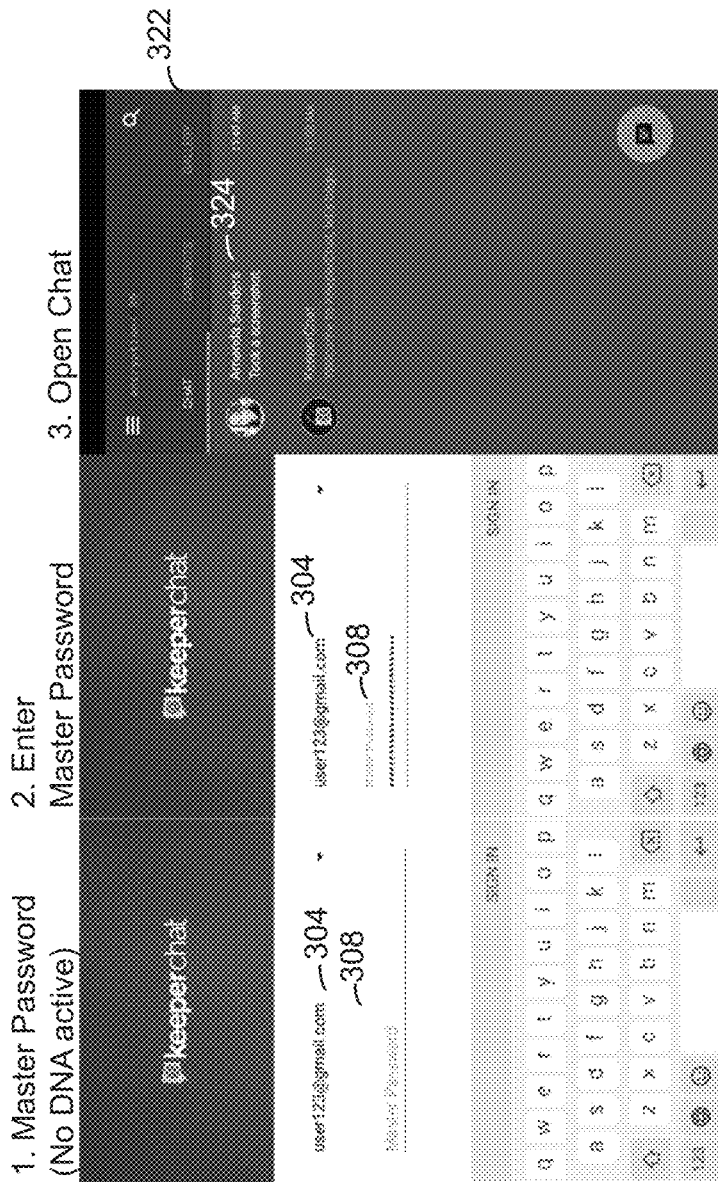


FIG. 6

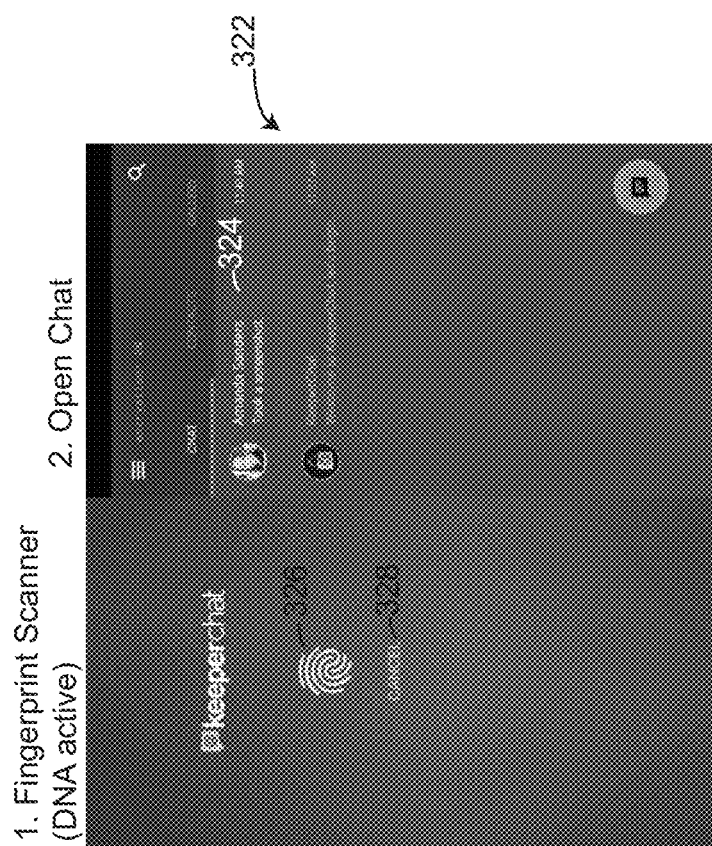


FIG. 7

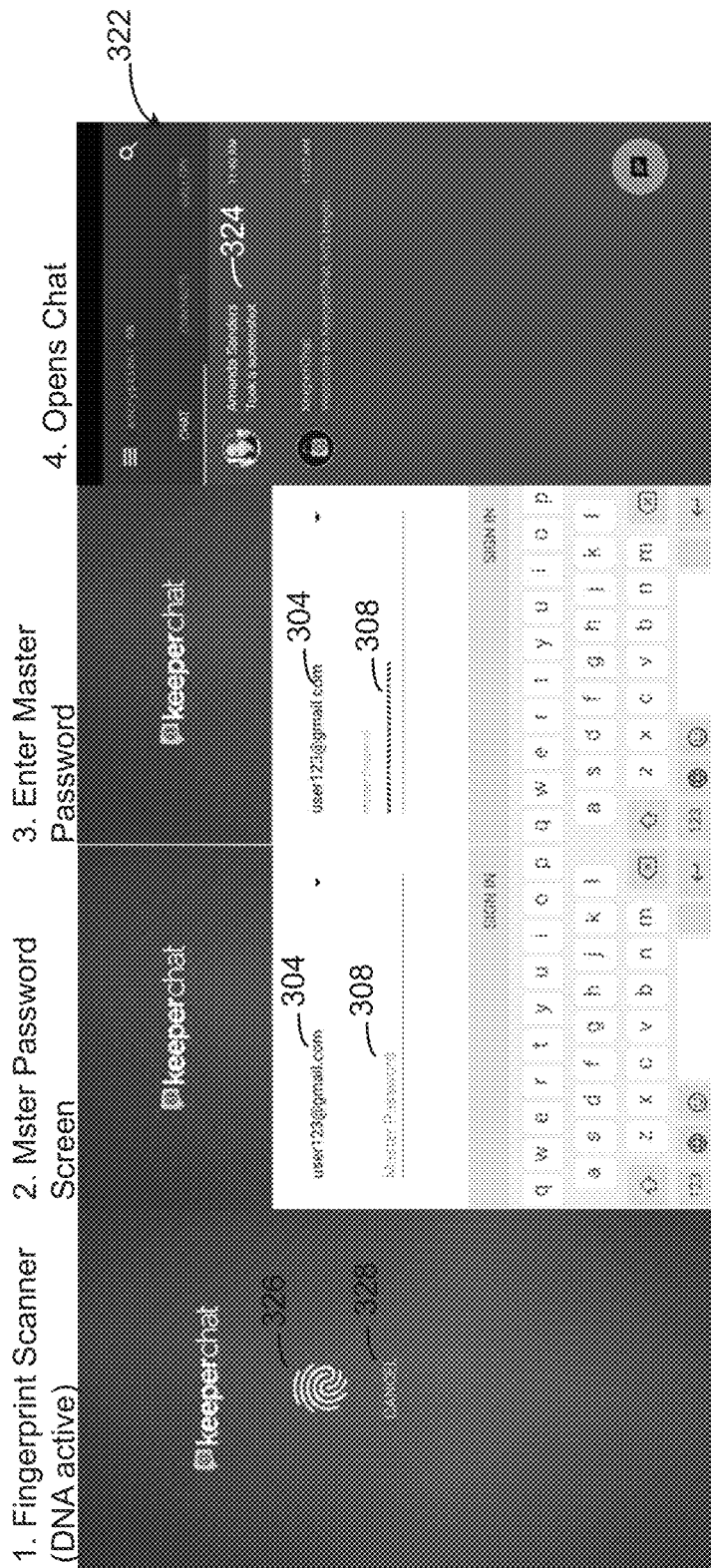


FIG. 8

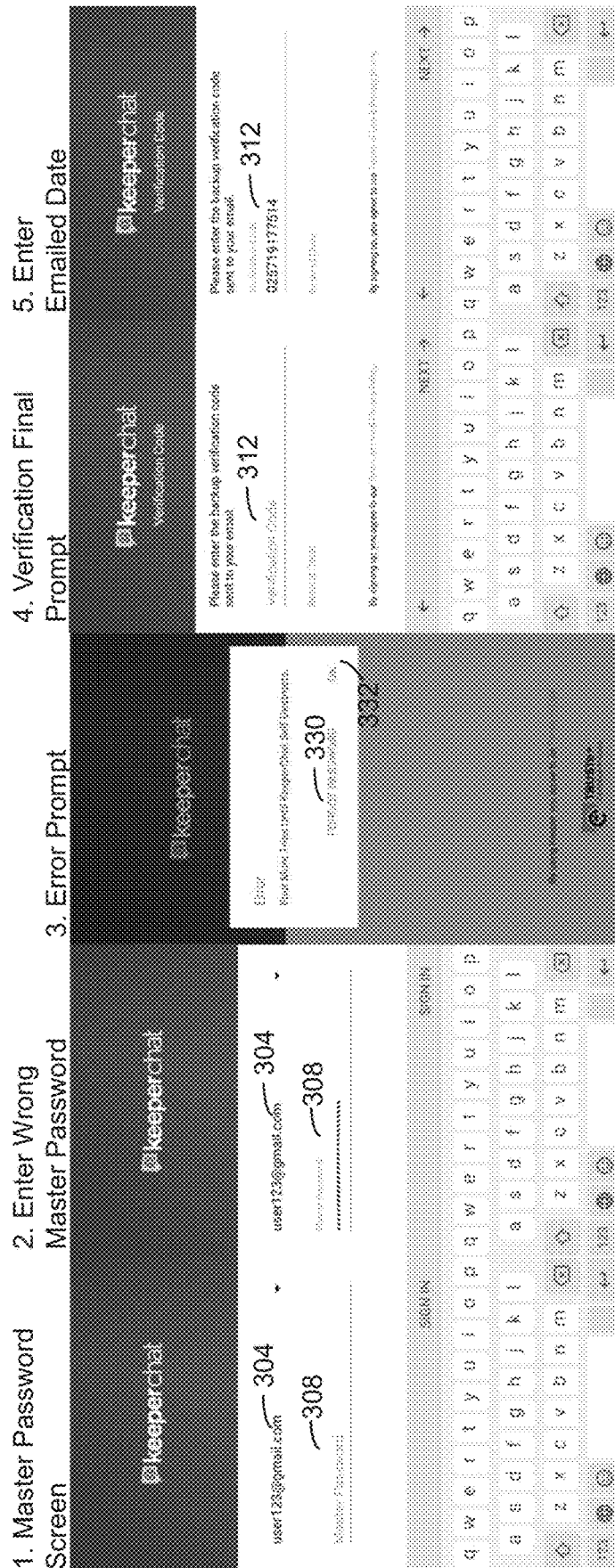


FIG. 9A

The image displays three sequential screenshots of the 'keeperchat' application interface, illustrating the setup process for a new user.

**Top Screenshot: Create New Master Password**  
 The screen shows the 'keeperchat' logo and the title 'Create New Master Password'. It features a numeric keypad for entering a password. The number '324' is entered in the first field, and '324' is entered in the second field. A 'DONE' button is located at the bottom right.

**Middle Screenshot: Create New Security Question**  
 The screen shows the 'keeperchat' logo and the title 'Create New Security Question'. It features a text input field for entering a security question. The text 'In what city did you meet your spouse or significant other?' is entered in the first field, and '316' is entered in the second field. A 'NEXT' button is located at the bottom right.

**Bottom Screenshot: Create New Security Answer**  
 The screen shows the 'keeperchat' logo and the title 'Create New Security Answer'. It features a text input field for entering a security answer. The text 'In what city did you meet your spouse or significant other?' is entered in the first field, and '316' is entered in the second field. A 'NEXT' button is located at the bottom right.

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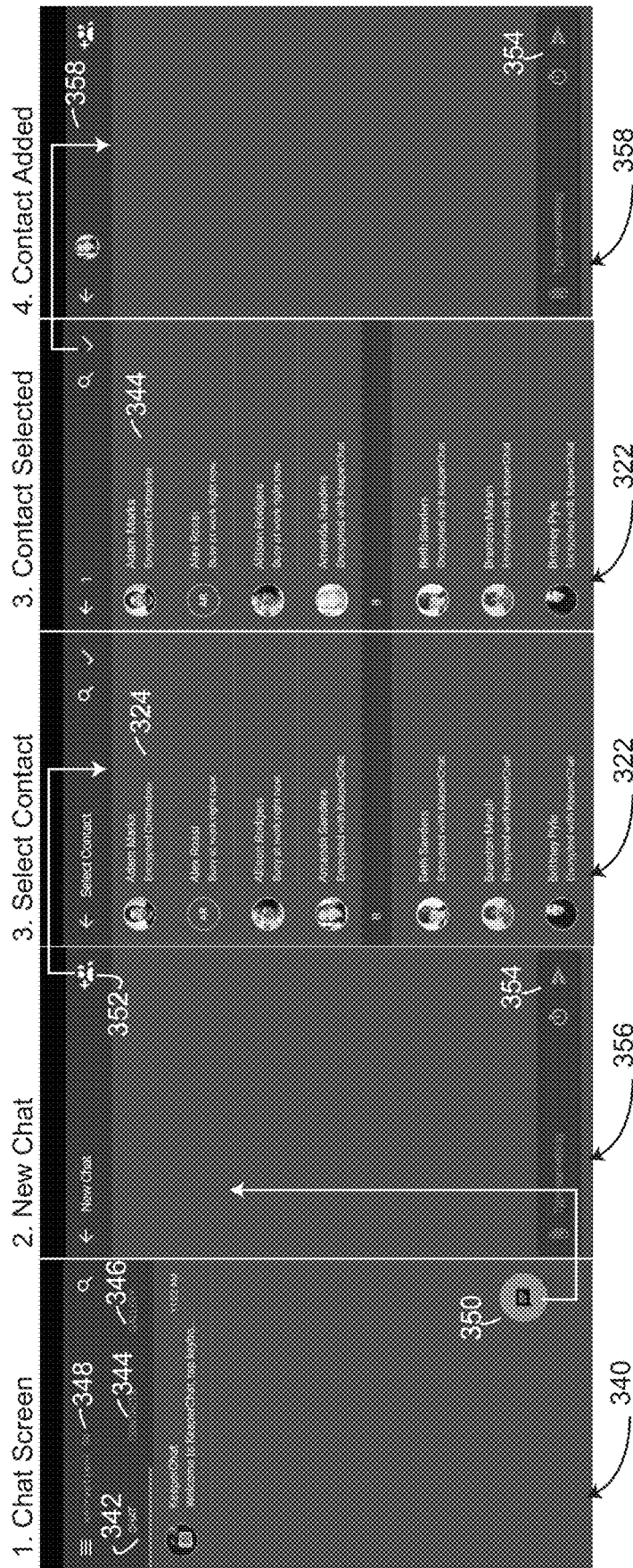


FIG. 10

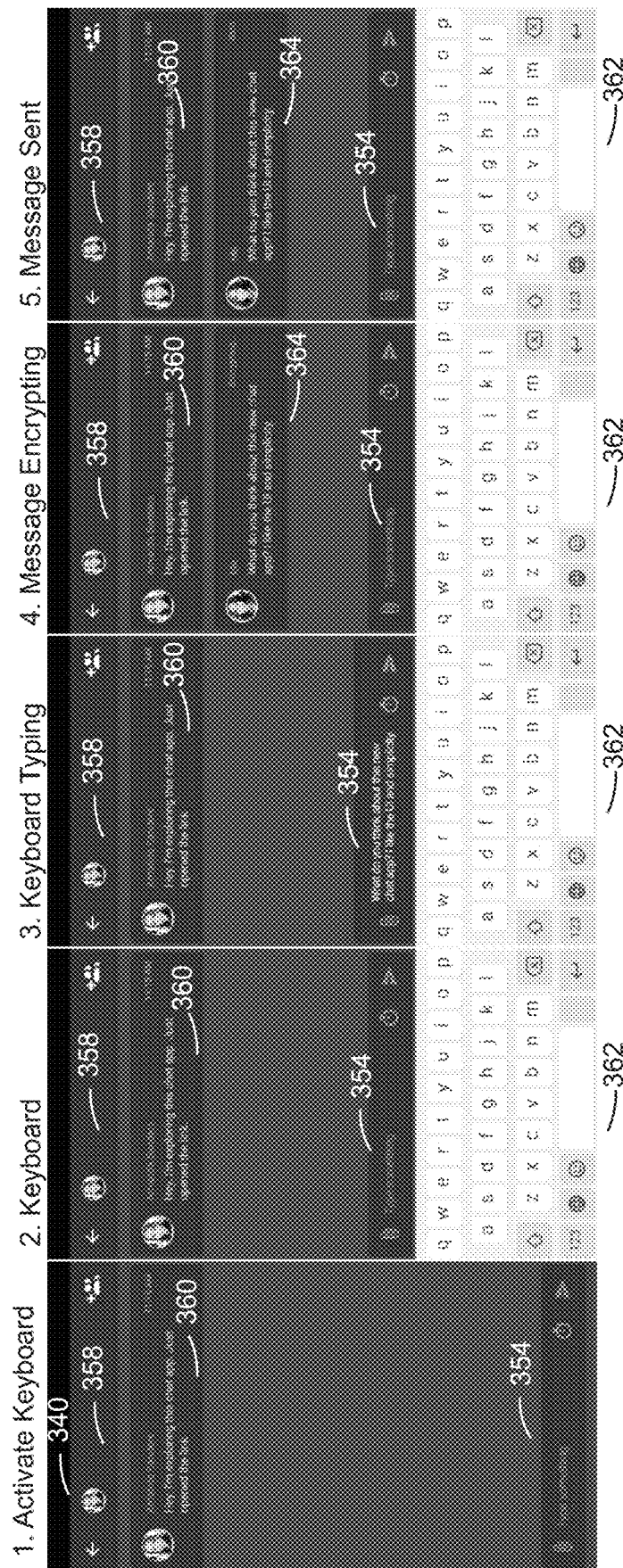


FIG. 11

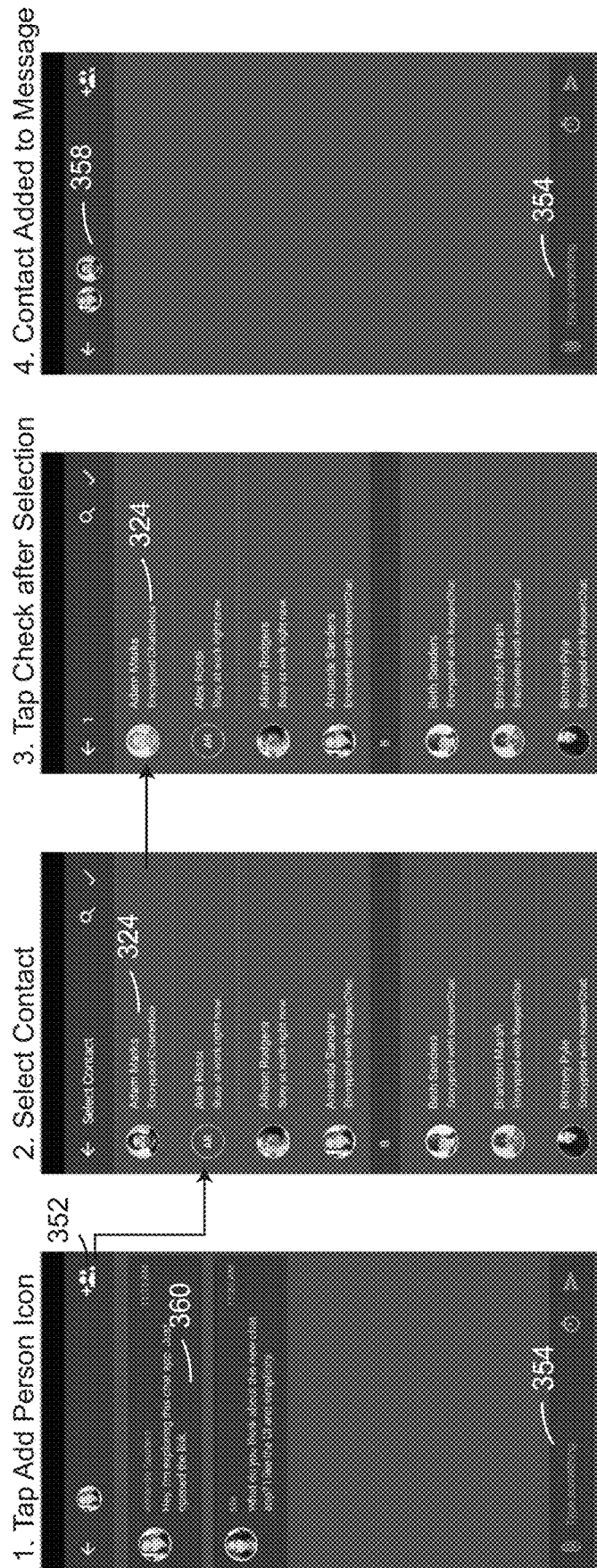
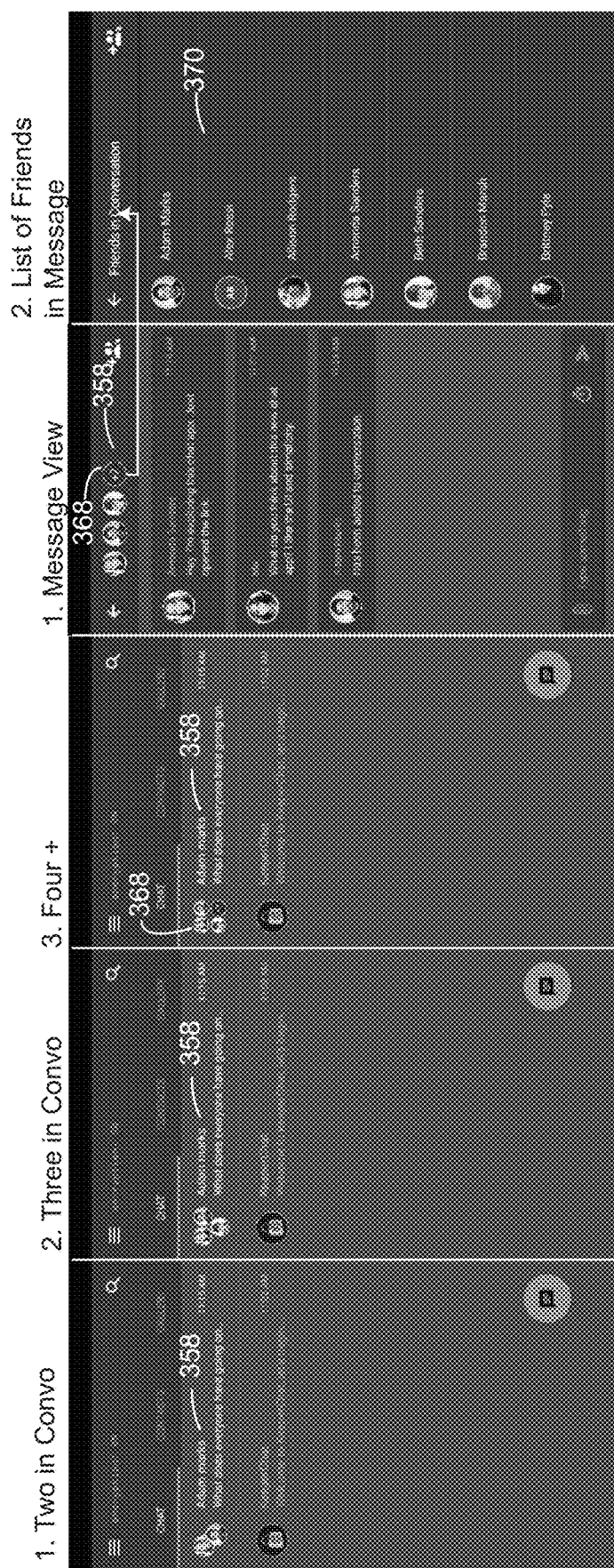


FIG. 12





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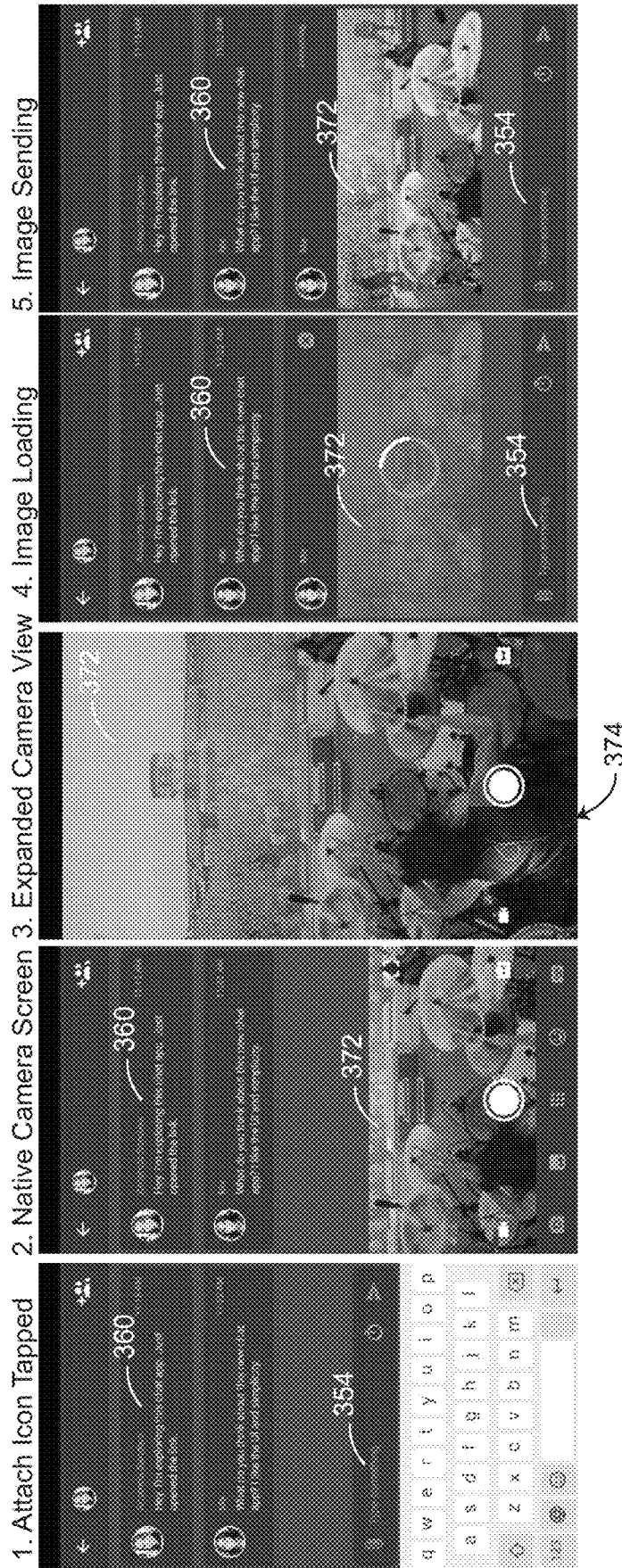


FIG. 14

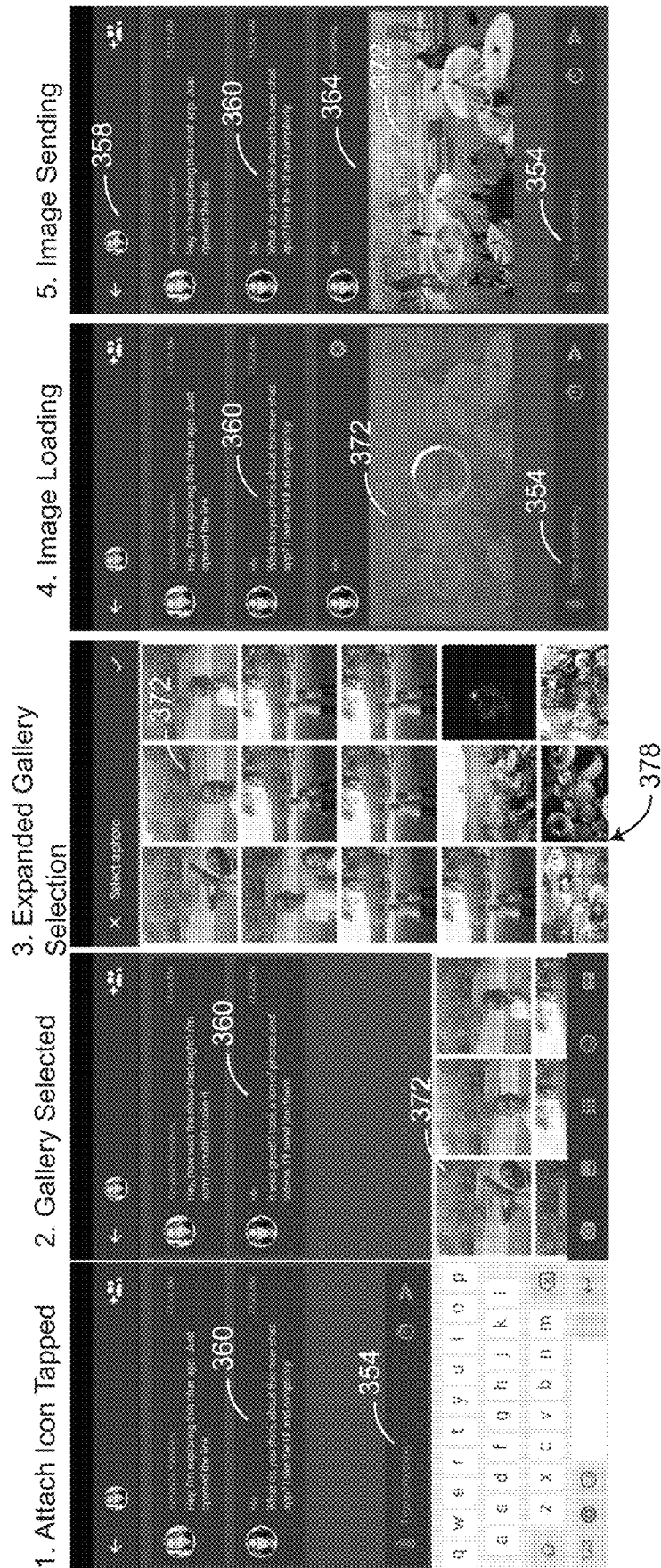
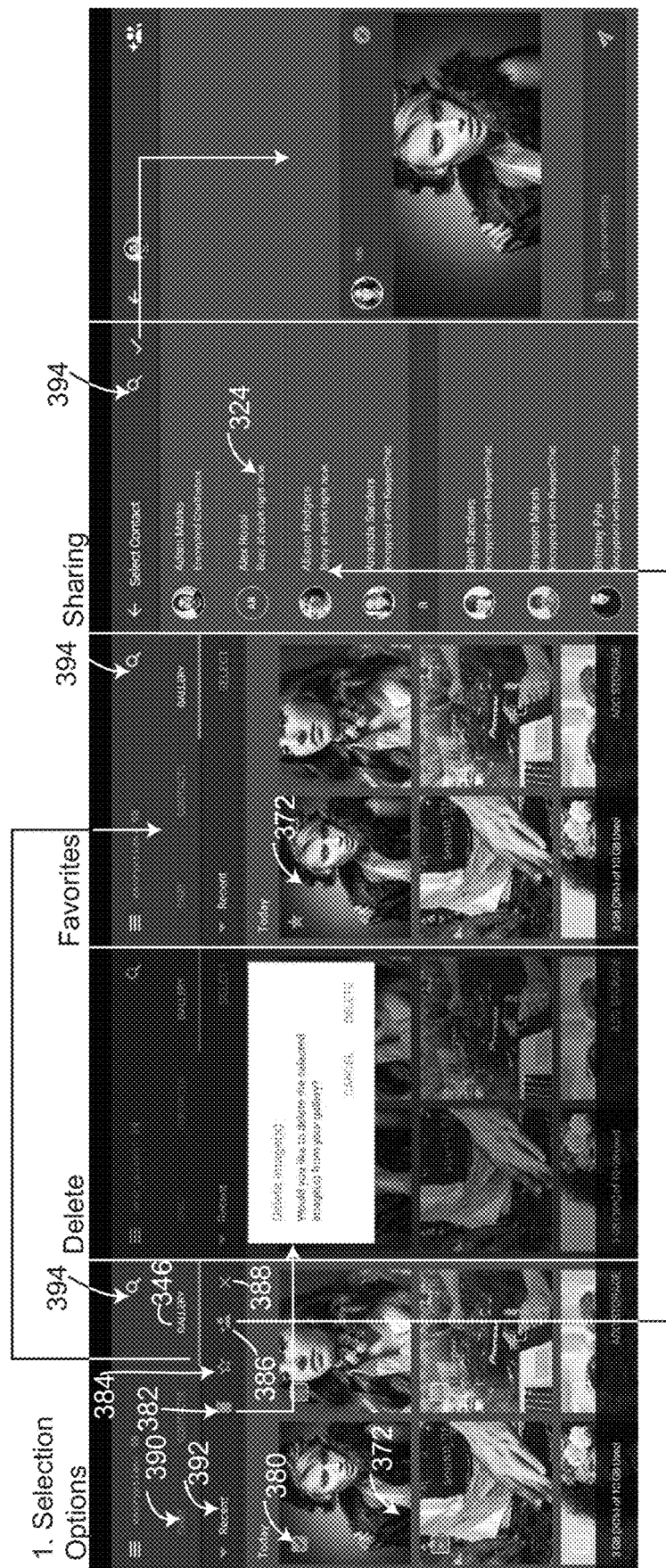


FIG. 15



FIG. 16



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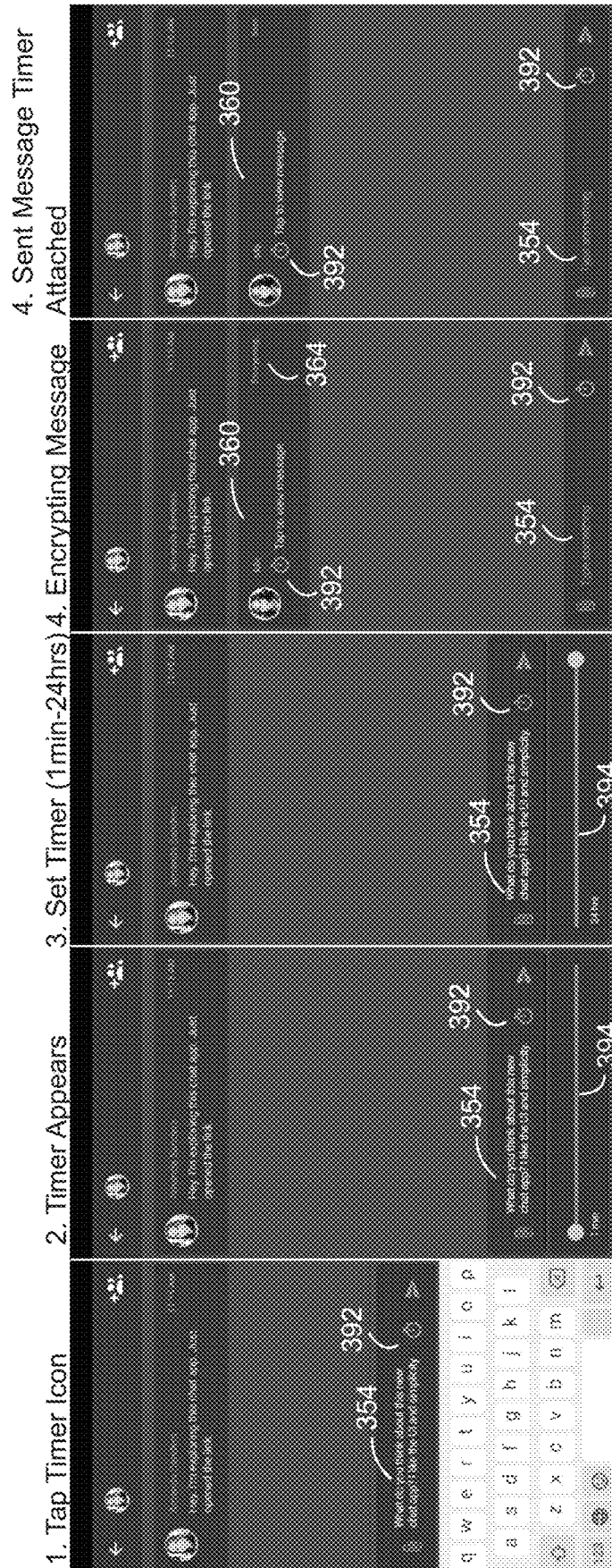


FIG. 18

1. Tap image to start timer
2. Timer Appears and begins countdown bar less than 1min remaining on both ends
3. Timer turns red when less than 1min remaining on both ends
4. Message deleted

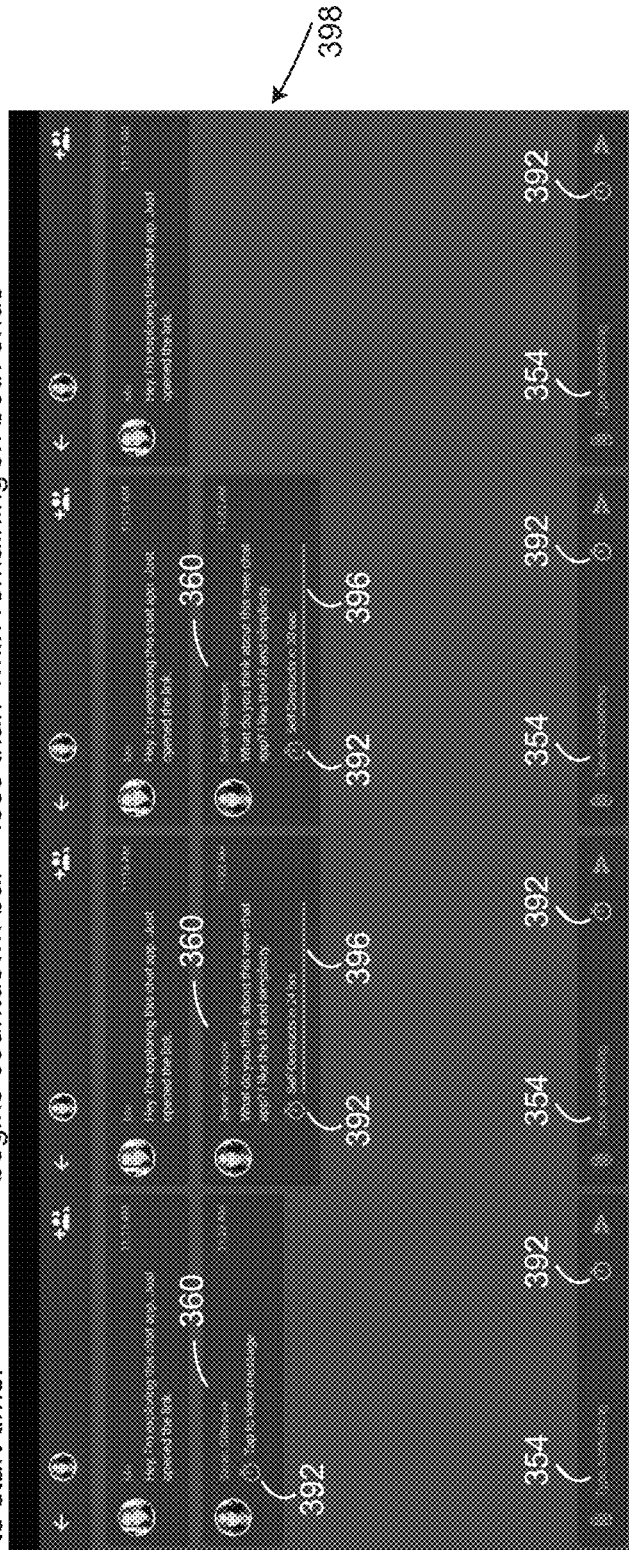


FIG. 19

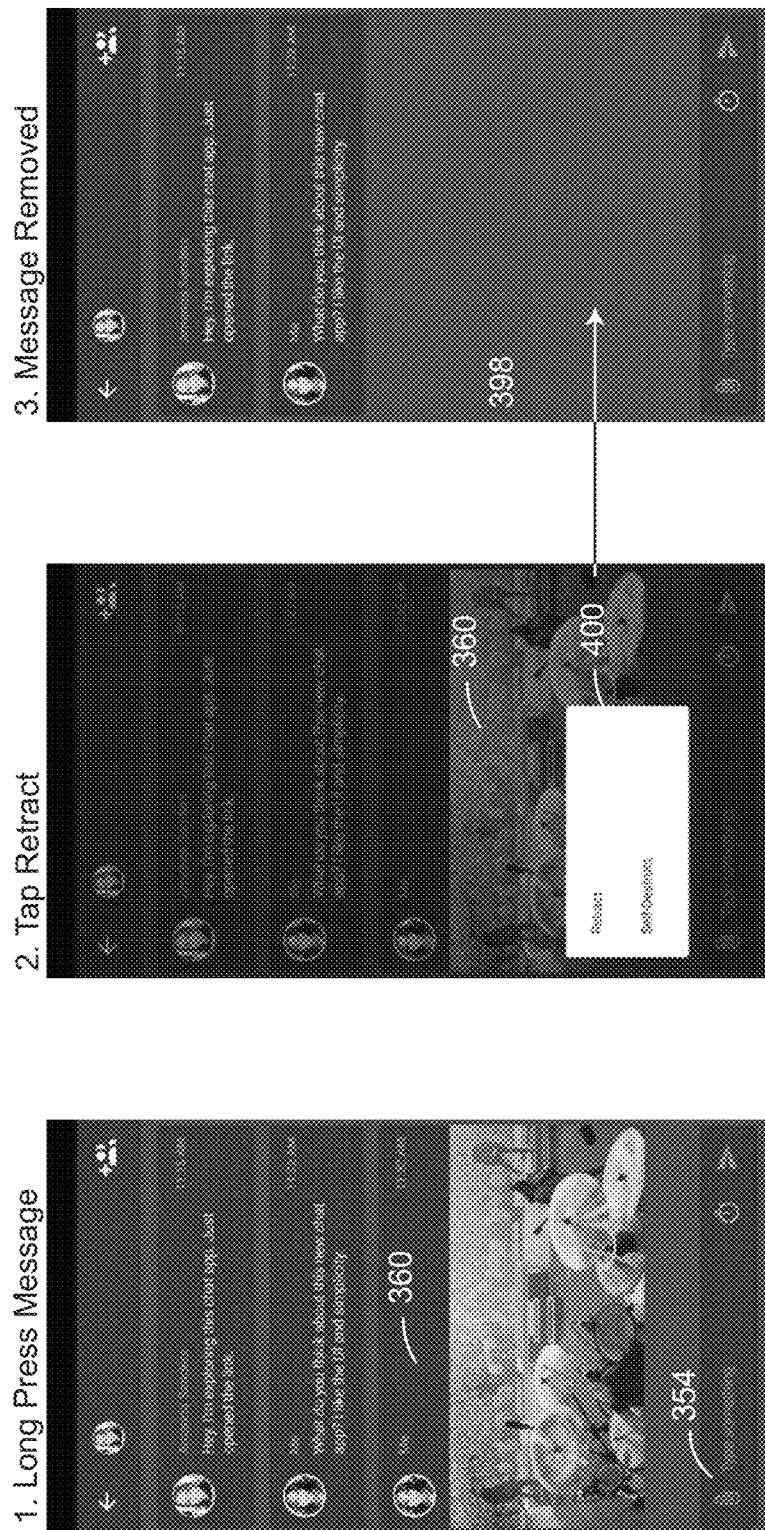


FIG. 20



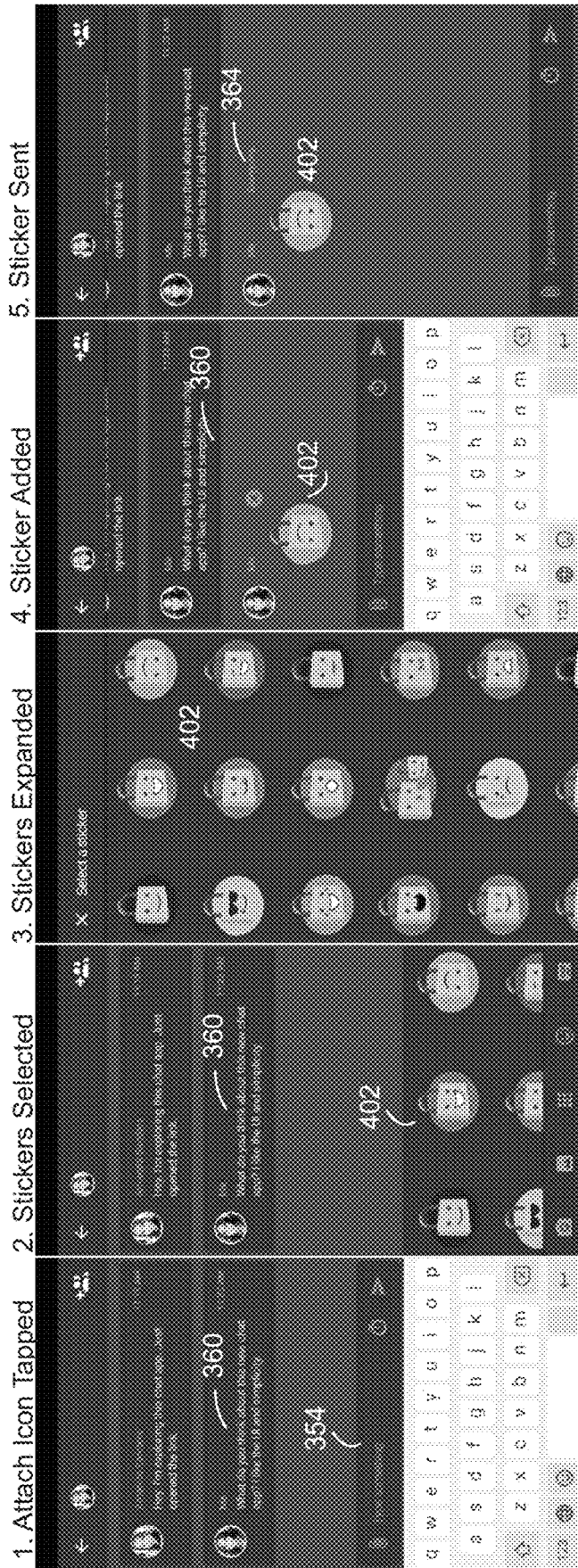


FIG. 21

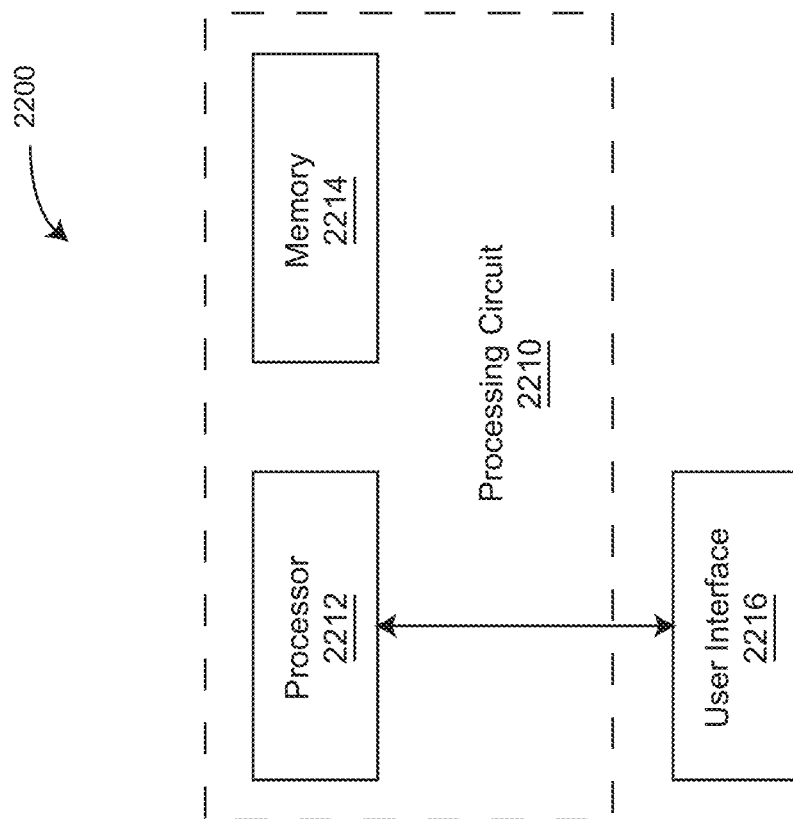


FIG. 22

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# SYSTEM AND METHOD FOR CHAT MESSAGING IN A ZERO-KNOWLEDGE VAULT ARCHITECTURE

## BACKGROUND

Instant messaging (IM) is a type of online chat that offers real-time text transmission over the Internet or a local area network. Short messages are typically transmitted bi-directionally between two parties, when each user chooses to complete a thought and select send. Some IM applications can use push technology to provide real-time text, which transmits messages character by character, as they are composed. More advanced instant messaging can add file transfer, clickable hyperlinks, voice over Internet protocol (IP), or video chat.

Several instant messaging applications are available, but today's known messaging applications are either not secure or they cannot operate over multiple devices with strong data retention. For example, most encrypted chat products use temporary one-time encryption keys for device-to-device chat, and the data is not available to other devices, or through device chat history. Also, chat messages on most traditional applications are stored in plain-text format which is not secure from unauthorized viewing.

## SUMMARY

In one aspect, a system and/or method includes facilitating secured chat messaging. An application module can derive a master password-based encryption key from a master password. The application module can generate a data key and encrypt the data key with the master password-based encryption key. The application module can generate a record key for encrypting chat messages of a chat thread and encrypt the record key with the data key. The application module can decrypt the chat messages in the chat thread with the record key, where the record key is decrypted with the data key, and where the data key is decrypted with the master password-based encryption key. The application module can display the decrypted chat messages.

This Summary is provided merely for purposes of summarizing some example embodiments so as to provide a basic understanding of some aspects of the disclosure. Accordingly, it will be appreciated that the above described example embodiments are merely examples and should not be construed to narrow the scope or spirit of the disclosure in any way. Other embodiments, aspects, and advantages of various disclosed embodiments will become apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the described embodiments.

## BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a block diagram of an example environment to provide chat messaging over devices in a zero-knowledge vault architecture.

FIG. 2 is a flow diagram of an example architecture and processing of data for securely storing chat messages.

FIG. 3 is a flow diagram of an example architecture and processing of data for secure login and chat messaging.

FIGS. 4-9 are screenshots of example signup and login architecture.

FIGS. 10-21 are screenshots of example messaging architecture via the application.

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FIG. 22 is a block diagram of an example processing module.

## DESCRIPTION

A system and method provide an encrypted, multi-platform messaging application for mobile and computer devices in a zero-knowledge security architecture. In some embodiments, an application module saves chat messages inside an encrypted vault so that any unauthorized person who has access to the device cannot access and view the messages. In some embodiments, the application module encrypts the messages, both at rest and in transit. In some embodiments, the application module can backup and restore the messages to protect the messages, e.g., in the event the device is lost, stolen, damaged or replaced. In some embodiments, the application module can provide a complete chat history to be displayed across multiple devices of a single account's platform. For example, the application module can provide synchronization of chat messages and history across smartphones, computers, tablets, etc. accessed by the single account. The application module can also utilize chat thread-level encryption keys that are only decryptable by the users in the chat thread.

FIG. 1 is a block diagram of an example environment to provide chat messaging to client-side devices **106** in a zero-knowledge vault architecture **100**. In some embodiments, the zero-knowledge vault architecture can provide high level security and privacy by: 1) encrypting and decrypting at the client-side devices **106**, not on the service provider servers **112**; 2) not storing plain text, e.g., human readable, data; 3) receiving data at the service provider server **112** in plain text; 4) not allowing the provider to view unencrypted data; 5) deriving keys to decrypt and encrypt data from a master password of the device **106**; 6) providing access control with multi-layer encryption at the device **106**, group and administrative levels; and/or 7) sharing of data uses public key cryptography for secure key distribution. The device **106** encrypts data before transmitting and storing the data in the service provider vault **104**. When data is synchronized to one or more other devices **110a-n**, the data remains encrypted until it is decrypted on the other devices **110a-n**.

For the sake of explanation, the zero-knowledge vault architecture **100** includes the client devices **106** performing chat messaging with other client devices **110a-n**, e.g., by sending chat messages **360** to, and receive chat messages **360** from, the other client devices **110a-n**. The devices **106** and **110a-n** can include, but are not limited to, one or more of smartphones, computers, e.g., a personal computers (PC), desktop computers, laptop computers, tablets, smart watches, gaming consoles, televisions, personal digital assistants (PDAs), etc. A service provider provides an application module **108** to be stored locally on the devices **106** and **110a-n** for encrypting and decrypting chat messages **360**. For the sake of simplicity, the architecture is described as the device **106** sending messages to and receive messages from device **110a-n**, and the devices **110a-n** receiving messages from and sending messages to the device **106**, but any combination of sending and receiving is possible. Sometimes the device **106** is referred to as a message sender device or initiating device, and device **110a-n** as a message receiver device, but any of the devices **106** and **110a-n** can send and receive chat messages **360**, and the application modules **108** for the devices **106** and **110a-n** encrypts and decrypts chat messages **360**. In some embodiments, the application module **108** may be stored remotely from the

devices **106** and **110a-n** to be accessed by the devices **106** and **110a-n**. For example, the application module **108** can be stored on a remote server and/or a cloud network, but not part of an infrastructure of the service provider servers **112**.

Service provider servers **112** provide a backend **102** for the service providers that can be implemented as digital vault **104** corresponding to device **106** and digital vaults **104a-n** corresponding to other devices **110a-n**. The digital vaults **104** and/or **104a-n** can be implemented as software applications hosted by the service provider's infrastructure, e.g., using a cloud or on-premise hosting provider, for storing encrypted chat messages **360** and encrypted keys as described in more detail below. In one example, the digital vaults **104** and **104a-n** are hosted by an AMAZON Web Service (AWS), or other secure cloud services platform, which can provide compute power, database storage, content delivery and/or other functionality of the backend **102**. The service provider servers **112** can use the digital vault **104** to securely store, protect, manage and/or share passwords, documents, digital assets, photos and other information, etc.

FIG. 2 is a flow diagram of an example architecture and processing of data for securely storing chat messages **360**. To create a service provider account with the service provider, the device **106** is used to input an email address **302** and a master password **308** which are received by the application module **108** (**202**). The service provider account is identified by the email address **302**, therefore the account can be used across multiple devices for the same user, e.g., smartphone, computer, tablet, etc. The application module **108** derives a master password-based encryption key **250** from the master password **308**, e.g., using Password-Based Key Derivation Function 2 (PBKDF2), or other password-strengthening algorithm (**204**). The master password-based encryption key **250** remains the same for the user across all devices and for all chat threads by the user. In some embodiments, settings of the application module **108** can be changed to increase a number of PBKDF2 rounds for key derivation, e.g., 1,000, 10,000, or 100,000, etc., to adjust the level of encryption when accessing the digital vault **104**. A higher iteration setting can increase the amount of time it takes for the device **106** to generate the master password-based encryption key **250** and authenticate into the vault **104** to decrypt, e.g., by a up to a few seconds. In any case, the time it takes for the device **106** to derive the master password-based encryption key **250** from the master password is purposely slow to make it unfeasible for all intents and purposes to crack the master password-based encryption key **250** with brute force attack. Likewise, it is unfeasible to brute force attack the encrypted data, since each individual record is encrypted with a unique 256-bit AES key, as described below.

To encrypt chat messages **360** for remote and local storage relative to the device **106**, the application module **108** generates a data key **252** and client key **254**, e.g., via a 256-bit Advanced Encryption Standard (AES), and public key/private key pair **256a,b**, e.g., 2048-bit Rivest-Shamir-Adleman (RSA) key pair (**208**). Other types of cryptographic algorithms can be used to generate the data key **252** and client key **254**. The application module **108** uses the data key **252** to encrypt data that is to be synchronized to the vault **104**, e.g., chat message and key data, as a backup (**206**). For sake of explanation, the client device **106** is referred to but the same can apply for client devices **110a-n** and vaults **104a-n**. Before saving the data key **252** to the vault **104**, the application module **108** encrypts the data key **252** with the master password-based encryption key **250** (**208**). The application module **108** stores the encrypted data key **252** and the

data key encrypted data to the vault **104** and locally on the device **106** (**210**). The master password-based encryption key **250**, which the device **106** derives from the master password on the fly, can be stored in a secure enclave of the device **106**, if the device **106** has support for physical key storage that is only accessible by use of a fingerprint or other biometric, e.g. iOS Keychain.

The application module **108** uses the client key **254** to encrypt data that is stored locally on the device **106** (**212**). The application module **108** encrypts the client key **254** with the master password-based encryption key **250** (**218**) and stores the master password-based encrypted client key **254** locally on the device **106**. For backup purposes, the application module **108** also encrypts the client key **254** with the data key **252** (**214**) and stores the data key encrypted client key **254** in the vault **104**, e.g., as a backup if the device **106** is lost, stolen or replaced, etc. (**216**).

The public key/private key pair **256a,b** are used by the application module **108** of other devices **110a-n** to share chat messages **360** with the device **106**, as described in more detail below. The application module **108** stores the public key **256a** (**222**) to the vault **104** without encryption (**224**). The client device **110a-n** uses the public key **256a** to encrypt the data to share with the device **106**. The application module **108** encrypts the private key **256b** (**226**) with the data key **252** (**228**), and stores the encrypted private key **256b** in the vault **104** (**230**). When the device **106** receives an indication of a new message being sent to it by the other devices **110a-n**, the application module **108** uses the data key **252** to decrypt the private key **256b**, and then the private key **256b** to decrypt a record key **264** which is used to decrypt the data, as described in more detail below.

FIG. 3 is a flow diagram of an example architecture and processing of data for secure login and chat messaging of the device **106**. The application module **108** generates the record key **264** for each chat message thread that is created by the device **106**, e.g., a 256-bit AES key. The application module **108** uses the record key **264** to encrypt the record data corresponding to chat messaging, e.g., text, pictures, video, stickers, invited contacts, etc. For data stored local to the device **106**, the application module **108** uses client key **254** to encrypt the record key **264** and stores the client key encrypted record key **264** locally to the device **106**. The application module **108** also encrypts the record key **264** with the data key **252** and stores in the data key encrypted record key **264** and corresponding record key encrypted data in the vault **104**, e.g., for backup.

The application module **108** can log in the device **106** using the email address **302**, the master password **308** and/or a biometric **240**, e.g., figure print, eye scan, etc. The application module **108** derives the master password-based encryption key **250** from the master password (**260**), and decrypts the locally stored client key **254** with the derived master password-based encryption key **250** (**262**). The application module **108** uses the decrypted client key **254** to decrypt a local record keys **264** (**266**). The application module **108** uses the record key **264** to decrypt the locally stored data, e.g., chat messaging and related, described in more detail below (**268**). The application module **108** can display the decrypted chat threads and record data on the device **106**.

To sign in the device **106** into the provider's backend **102**, e.g., to view chat messages **360** sent from other devices **110a-n** and/or backup data stored on the backend **102**, the application module **108** can authenticate the master password with a PBKDF2 hashing algorithm, or other password-strengthening security algorithm. When a device **110a-n**

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sends a chat message to device **106**, the device **106** can receive a short message service (SMS) message that a new chat messaging message has been sent to the device **106**. The user can then sign in to the application module **108** to connect the device **106** with the service provider's backend **102**. In some embodiments, the device **106** can connect with the service provider's backend **102** by the biometric **240**, e.g., fingerprint, eye scan, etc., and/or master password **308**. The application module **108** can also determine if multiple forms of identification are required for authentication, e.g., in addition to the master password or biometric **240** (**274**). If the application module **108** requires other forms of identification, the application module **108** can prompt the device **106** for another form of identification, e.g., a phone number **310** described below (**276**). In some embodiments, the device **106** supports various forms of two-factor authentication to further protect access to the digital vault **104**, e.g., two or more of fingerprint authentication, e.g. APPLE Inc. TOUCHID, short message service (SMS), GOOGLE authenticator, authentication by DUO, SecurID, Apple Watch authentication, Android Wear authentication, etc. Once confirmed, the application module **108** authenticates the device **106** on the service provider's backend **102**.

The application module **108** uses the derived master password-based encryption key **250** to decrypt the data key **252** stored in the vault **104** (**280**). When device **110a** invites device **106** to the chat thread, the device **110a** requests from the backend **102** the public key **256a** for device **106**. The application module **108** for device **110a** encrypts the record key **264** for the chat thread with the received public key **256a**, and synchronizes the encrypted record key **264** and corresponding record data with the vault **104** for the device **106**. The application module **108** for device **106** uses the decrypted data key **252** to decrypt the private key **256b** stored in the vault **104** (**282**), and decrypts the record key **264** with the private key **256b** (**284**). The application module **108** can then decrypt the record data with the record key **264** (**286**), and display the decrypted records and chat threads (**270**).

For optimization, the application module **108** can then re-encrypt the record key **264** with the data key **252** for devices **106**, e.g., since AES encryption can be faster than RSA encryption (**288**). The application module **108** can then store the client key encrypted record key **264** and encrypted data local to the device **106**. Thereafter, when the device **106** logs in with the master password **308**, the device **106** can decrypt the client key **254** with the master password-based encryption key **250**, and decrypt the record key **254** with the client key **254**, etc., as described above. In this way, the application module **108** can provide for secure chat messaging for consumer and/or business uses alike. The service provider's backend **102** employs a zero-knowledge security architecture, e.g., provided by KEEPER SECURITY, Inc. or other service provider, for which the device **106** always, not the service provider, has full knowledge and control of the master password **308** and the master password-based encryption key **250**, all of which reside and/or operate locally on the device **106**. The application module **108** can communicate with the digital vault **104** for encrypting, storing, organizing and protecting the chat messages **360** and message attachments, e.g. files, stickers, photos and videos, etc. on all devices **106** registered with the service provider via the email address, as described in more detail below.

Once the device **106** gains access to the digital vault **104** upon successful entry of the master password **308** and/or biometric **240**, the device **106** can engage in private and secure messaging sessions with other devices **110a-n** using

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the service provider's application module **108**. Messaging is digital vault **104** to digital vault **104a-n**, from one device **106** to other devices **110a-n**. In some embodiments, new devices are onboarded to the application module **108** upon being invited by an existing device or by receiving a notification that they have received a private message from the service provider. To open a message for the first time, when the device **106** has not yet installed the application module **108** yet, the device **106** is onboarded onto the application module **108** as a new user. This creates a private, secure form of chat messaging.

FIGS. 4-9 are screenshots of example signup and login architecture. In FIGS. 4A-B, the application module **108** displays a login screen **300** on the device **106**. The login screen **300** includes a field **302** for entering an email address **304** related to the user of the device **106**. The email address **304** is entered by a user interface **2116** of the device **106** (FIG. 22), e.g., via a keyboard **303** of the device **106**. If the application module **108** does not recognize the entered email address **304**, the application module **108** provides a name field **306**, master password field **308**, region field **309** and telephone number field **310** for inputting the respective information. As another layer of security, the application module **108** can also send a verification code to the inputted telephone number **310** and provide a verification code **312** field for the user to enter the received verification code into the application module **108**. When the device **106** is signed into the application module **108**, the application module **108** can provide a button **314** for the device to invite friends.

In FIG. 5, upon a subsequent login attempt to the user account associated with the email address **304**, the application module **108** requests entry of the master password **308** into the field. The application module **108** can request that security answers be provided via security answer field **316** and confirm security answer field **318**, related to chosen security question **320**. Thereafter, the application module **108** can request the verification code **312** and/or answer to a security question **320** be entered on the device **106a** when new devices **106b-n** are first added to the user account associated with the email address **304**. Additionally or alternatively, the application module **108** can request the verification code **312** and/or answer to the security question **320** be entered on the device **106a** when an email address **304** of the user is new to the application **106** but known by the service provider, e.g., for other services of the service provider. In that case, the application module **108** can request a selected region **309** and entry of the telephone number **310** for sending a verification code **312**. The application module **108** can request the master password **308** and answer **316** to the security question **320** before providing the button **314** to invite friends.

In FIG. 6, when a device **106** is registered with the application module **108**, the application module **108** can request the user's email address **304** and master password **308** to determine and display a user contact screen **322** that lists registered chat contacts **324** associated with the user's account. In FIG. 7, when the email address **304** is established with the application module **108** for the device **106**, the application module **108** can be accessed with a fingerprint scan **326**. Moreover, a cancel prompt **328** allows the fingerprint scan **326** to be bypassed. In FIG. 8, if the fingerprint scan **326** is bypassed, the application module **108** can prompt the user to enter the email address **304** and the master password **308** for the account to open the contact screen **322** of the application module **108**.

In FIGS. 9A-B, if the master password **308** is forgotten, or entered incorrectly more than a determined number of

times, the application module 108 can display an error prompt 330. In some embodiments, the application module 108 includes a self-destruct protection to wipe all the data associated with the account from the vault 104, including all chat threads and keys, after a determined number of incorrect login attempts. When a third-party, such as a hacker, attempts to break into the device 106, the application module 108 deletes the data stored on the device 106, e.g., after a number of incorrect password attempts. The error prompt 330 can indicate that the application module 108 will destruct the chat messages 360 if an incorrect password is entered a determined number of more times. If the user regains control of the device 106, or obtains a replacement device, the application module 108 can restore data to the device 106, e.g., via encrypted data and encrypted keys stored in vault 104, upon successful re-authentication of the device 106.

For secure account recovery, e.g., in the event the user forgets the master password, the application module 108 can encrypt a second copy of the data key 252 with the selected security answer. Upon completion of a second factor authorization, answering the security question, and optionally completing a third factor of authentication, e.g. via SMS, the application module 108 decrypts the data key 252 on the client device 106. To accommodate recovery, the application module 108 can provide a forgotten password link 332. When the forgotten password link 332 is tapped/clicked, the application module 108 displays the field for the verification code 312 and sends a verification code to the telephone number 310 on record. If the verification code 312 is entered correctly to the device 106, the application module 108 requests the security answer 316. When the security answer 316 is answered correctly, the application module 108 prompts for entry of a new master password 308. Upon entry of the master password 308, the application module 108 displays the contact screen 322 on the device 106.

FIGS. 10-21 are screenshots of example messaging architecture via the application module 108. In FIG. 10, the chat screen 340 can include tabs for the device 106 to display chat functionality 342, contacts 344 and a gallery 346. All files 372, sent or received by the device 106, can be stored in the gallery 346. The files can include files stored on the device 106 and/or files stored remote from the device 106 but accessible by the device 106, including but not limited to photos, videos, other media, documents, etc. The application module 108 can provide an encryption on indicator 348, and an icon 350 can be tapped/clicked to compose a new chat message thread. The new chat message screen 356 can include an icon 353 for selecting a contact, e.g., from the list of contacts 324, to join to a chat message thread, and a field 354 for typing a message, adding an attachment, sending the message, etc. As contacts 324 are added to the chat message thread, they can be listed at the top of the screen 358. The application module 108 can also delete contacts 324 from the chat message thread, e.g., when the application 108 receives a long press on the contact 324. In FIG. 11, messages 360 can appear on the chat screen 340 as the device 160 sends and receives them. The application module 108 can provide the keyboard 303 displayed by the device 106 for entering messages 360. The message 360 can display an encrypting indicator 364 as the application module 108 encrypts the message and sending status information 366, e.g., when the application module 108 sent the message. In FIG. 12, the application module 108 can add new contacts to the message thread, e.g., by tapping/clicking button 352 to access the list of contacts 324, and then receiving a click/tap for the contact to add. The application

module 108 can display the new contact at the top of the screen 358. In FIG. 13, the application module 108 can display a number icon 368 indicating that more than a determined number of contacts are part of the chat message thread. Additionally or alternatively, the application module 108 can display a list 370 of all the contacts on the thread.

In FIG. 14, the application module 108 can attach selected files 372 to the chat messages 360. In some embodiments, the application module 108 provides an expanded camera view 374. From the camera view 374, the device 106 can receive a click/tap indicating to take a picture of the scene in the camera view 374. The application module 108 can attach the picture to chat message 360 and send the picture. In FIG. 15, the application module 108 can receive the file 372 from a camera roll. The application module 108 can provide an expanded view 378 of the gallery 346 for selection of a photo to attach to the chat message 360. The application module 108 attaches the photo to the chat message 360, encrypts the message, and then sends the message to the selected contact(s) listed at the top of the screen 358. In FIG. 16, the application module 108 can provide a selection box 380 for each file 372, to receive a selection of the file 372 to attach to the chat message 360. The application module 108 can provide sorting of the files 372 by date, e.g., recent or older, favorites, a dragged and dropped order, etc. In FIG. 17, a user interface 390 of the gallery 346 can include a delete icon 382, a favorites icon 384, a share icon 386 and a close icon 388, for the device 106 to delete files, show only files marked favorites and open the list of contacts 324 for sharing the file, respectively. The user interface 390 can also include a drop down menu 392 for sorting files 372 by recent, favorite, older, etc. In some embodiments, the application module 108 provides navigation from one file to the previous or next file by swiping the file displayed on the device 106. The application module 108 can also provide a search icon 394 to search for files 372 using text.

In FIG. 18, the application module 108 can provide a self-destruct option for limited a time of accessibility of the chat messages 360. The field 354 for typing the chat message can display a timer icon 392. When the timer icon 392 is tapped/clicked, the application module 108 can display a timer interface 394, e.g., in the form of a slider bar or other time of timer interface 394. The timer interface 394 can allow the destruct time period to be set, e.g., from one minute to twenty-four hours, or other determined time intervals. Once the destruct time is selected using the timer interface 394 and the message 360 is entered and determined to be sent, the application module 108 can display the encrypting indicator 364 while the message 360 is being encrypted. The sent message 360 can show the timer icon 392 to the message sender and receiver. In FIG. 19, when the receiver receives the message 360, e.g., on the other device 110a-n, the application module 108 provides viewing of the message 360 by a tap of the message. The message 360 indicates the timer icon 392, and the time remaining to message destruction icon 396. The application module 108 begins to count down the time remaining when the message 360 is opened. The initial time remaining is based on the time set by the timer interface 394 by the sender. The time remaining to destruction icon 396 can indicate when there is less than a determined time remaining, e.g., one minute or less, by blinking and/or changing color, etc. After the view time has elapsed the application module 108 deletes the message 360 for both the sender and the receiver(s). Therefore, the devices 106 and 110a-n can no longer display the chat message 360 (398).

In FIG. 20, the application module 108 allows the chat messages 360 to be simultaneously deleted on both the sender and receiver devices 106 and 110a-n. In some embodiments, when receiving a long press on the chat message 360, the application module 108 displays a delete message confirmation box 400, requesting confirmation to delete the message or cancel the deletion. Upon confirmation, the application module 108 deletes the chat messages 360 on both the sender and receiver(s) devices 106 and 110a-n (398). In FIG. 21, the application module 108 can provide stickers 402 to attach to the chat messages 360. The stickers 402 can add life and emotion to the chat sessions. The application module 108 provides that the sticker 402 can be selected from a plurality of sticker images and attached to the chat message 360. The application module 108 encrypts the chat message 360 with the sticker 402 before sending the message 360 from the sender device 106 to the receiver device 110a-n.

For multi-device synchronization of a single account with a complete chat thread history, e.g., multiple message threads with various user devices, the application module 108 can synchronize the chat history across all the devices 106 for which the account is registered with the master password for the user on those devices 106. In some embodiments, the data stored in the vault 104 for the client device 106 is synchronized across any number of user account devices 106. An advantage is that the number of synchronized devices 106 is not limited as with other messaging applications. In some embodiments, the application module 108 provides a platform and device-wide architecture, e.g., to operate on smartphones, tablets and computer, and across various operating systems, including by not limited to, IOS, ANDROID, WINDOWS, e.g., phones and SURFACE, BLACKBERRY, KINDLE, NOOK, MAC, PC, etc. In some embodiments, the device 106 can select customizable themes with different colors and patterns.

In some embodiments, the device 106 can auto-logout the application module 108 after a determined time period of inactivity, for protection of data stored in the vault 104. The application module 108 can be used set an auto-logout timer in the settings screen of the application module 108 to protect an integrity of the data in the event the user steps away from the device 106. In some examples, this protects the vault 104 in not leaving it exposed to an outside threat. In some embodiments, the device 106 can self-destruct messages upon a determined time-out period being reached. The device 106 can set the self-destruct timer on all chat messages 360 stored in the vault 104, or can set a timer on individual chat messages 360 to a recipient and/or to individual recipients. Once the recipient opens the chat messages 360, the timer starts. Once the time counts down to zero, the chat message 360 is permanently eliminated from both the sender's and receiver's devices.

In some embodiments, the application module 108 can provide device-to-device voice calling, e.g., private voice calls that can include voice and video calls. In some embodiments, the application module 108 can be configured to record voicemail messages inside the vault 104 in the event they miss a voice call. In some embodiments, the application module 108 can provide group chats, e.g., the application module 108 can set up and execute private and secure group chats with other devices that include the application module 108. In some embodiments, the application module 108 can attach images from a camera roll to the messages. When images are selected from the device's 106 camera roll, they are encrypted and uploaded into the device's vault and stored inside an image gallery inside the vault. In some

embodiments, the images taken from the application module 108 using the camera of the device 106 are not saved on the camera roll of the device 106 for security purposes. The device 106 can be configured to take photos and videos, and attach them to the messages, directly via the vault. The images and video files do not reside, nor are they stored, on the device's camera roll. In some embodiments, all images, videos and files are stored in the vault 104. The images and video are fully encrypted at rest and in transit, for backup protection in the vault 104, and when used for syncing across multiple devices 106, e.g., smartphone, computer, tablet, etc.

In some embodiments, devices 106 that have both a password account and a chat account with the service provider can toggle between the vault for the password account and the vault for the chat account. The device 106 can also deep link with other application module 108 users, when engaged in a message thread, into a password vault record. The login credentials for both the password vault and the chat vault can be the same for the device 106. If the device 106 creates a password management vault first, onboarding the device 106 into the messaging chat can be simple since they use the same master password or biometric 240 to login.

FIG. 22 is a block diagram of an example processing module 2200 of the device 106. The systems and methods described above may be implemented in many different ways in many different combinations of hardware, software firmware, or any combination thereof. In one example, the processing module 2200 may enable functions of the application module 108 of the device 106. It can be appreciated that the components, devices or elements illustrated in and described with respect to FIG. 22 below may not be mandatory and thus some may be omitted in certain embodiments. Additionally, some embodiments may include further or different components, devices or elements beyond those illustrated in and described with respect to FIG. 22.

In some example embodiments, the processing module 2200 may include processing circuitry 2210 that is configurable to perform actions in accordance with one or more example embodiments disclosed herein. In some examples the processing circuitry 2210 includes the microcontroller 140 or other processor. The processing circuitry 2210 may be configured to perform and/or control performance of one or more functionalities of the device 106. The processing circuitry 2210 may be configured to perform data processing, application execution and/or other processing and management services according to one or more example embodiments. In some embodiments, the processing module 2200 or a portion(s) or component(s) thereof, such as the processing circuitry 2210, may include one or more chipsets and/or other components that may be provided by integrated circuits.

In some example embodiments, the processing circuitry 2210 may include a processor 2212 and, in some embodiments, such as that illustrated in FIG. 22, may further include memory 2214. The processor 2212 may be embodied in a variety of forms. For example, the processor 2212 may be embodied as various hardware-based processing means such as a microprocessor, a coprocessor, a controller or various other computing or processing devices including integrated circuits such as, for example, an ASIC (application specific integrated circuit), an FPGA (field programmable gate array), some combination thereof, or the like. Although illustrated as a single processor, it can be appreciated that the processor 2212 may include a plurality of processors. The plurality of processors may be in operative

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communication with each other and may be collectively configured to perform one or more functionalities of the processing module 2200 as described herein. In some example embodiments, the processor 2212 may be configured to execute instructions that may be stored in the memory 2214 or that may be otherwise accessible to the processor 2212. As such, whether configured by hardware or by a combination of hardware and software, the processor 2212 is capable of performing operations according to various embodiments while configured accordingly.

In some example embodiments, the memory 2214 may include one or more memory devices. Memory 2214 may include fixed and/or removable memory devices. In some embodiments, the memory 2214 may provide a non-transitory computer-readable storage medium that may store computer program instructions that may be executed by the processor 2212. In this regard, the memory 2214 may be configured to store information, data, applications, instructions and/or the like for enabling the processing module 2200 to carry out various functions in accordance with one or more example embodiments. In some embodiments, the memory 2214 may be in communication with one or more of the processor 2212, the user interface 2216 for passing information among components of the processing module 2200. The user interface 2216 can include one or more of a keyboard, a keypad, a mouse, a trackball, a touchscreen, a stylus, etc.

The disclosure provided herein describes features in terms of preferred and exemplary embodiments thereof. Numerous other embodiments, modifications and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure.

What is claimed is:

1. A computer-implemented method for facilitating secured chat messaging between a application module corresponding to a first user and a second application module corresponding to a second user on the first application module, the method comprising:

deriving a master password-based encryption key from a master password;

generating a data key;

encrypting the data key with the master password-based encryption key;

sending the encrypted data key to a first service provider vault corresponding to the first user;

generating a first key pair comprising a first public key and a first private key corresponding to the first user;

storing the first public key in the service provider vault without encryption for the second application module to receive from the service provider vault;

generating a record key;

encrypting chat messages of a chat thread using the record key;

(e) encrypting, by the application module, the record key with the data key;

decrypting the chat messages in the chat thread with the record key for display on the first client device;

receiving a second public key from the second client device;

encrypting the record key using the second public key; and

synchronizing the encrypted record key and encrypted chat messages in the chat thread with a second service provider vault corresponding to the second user, where the encrypted record key is accessed by a second application module corresponding to the second user, and decrypted using a second private key in a second

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key pair corresponding to the second user for decryption of the chat messages in the chat thread by the second application module.

2. The computer-implemented method of claim 1, where the first application module executes on a first client device.

3. The computer-implemented method of claim 1, wherein the master password synchronizes chat messages across various devices.

4. The computer-implemented method of claim 1, further comprising simultaneously deleting by the application module the chat thread on a sender device and receiver device.

5. The computer-implemented method of claim 1, further comprising self-destructing a chat message of the chat thread by the application module after a determined time period has elapsed after viewing the chat message.

6. The computer-implemented method of claim 5, further comprising displaying a time remaining to self-destruction.

7. The computer-implemented method of claim 1, further comprising decrypting by the application module a private key paired with the public key.

8. The computer-implemented method of claim 1, further comprising:

receiving by the application module a public key from another device to add to the chat thread; and

encrypting by the application module the record key with the public key.

9. The computer-implemented method of claim 1, where a complete chat thread is displayed across multiple devices including a same master password for the service provider.

10. The computer-implemented method of claim 1, where the master password-based encryption key is derived with a password strengthening algorithm.

11. The computer-implemented method of claim 10, further comprising generating a client key, where the client key encrypts data stored local to a client device corresponding to the first user.

12. The computer-implemented method of claim 1, further including providing a display for the client device, the display configured to display decrypted chat messages.

13. The computer-implemented method of claim 1, wherein the application module is configured to self-destruct the chat messages after a determined time period for both a sending client device and a receiving client device.

14. The computer-implemented method of claim 1, wherein the other client device re-encrypts the record key with a data key of the other client device.

15. The computer-implemented method of claim 1, wherein a complete chat thread is displayed across multiple devices including a same master password for the service provider.

16. A computer-implemented method for facilitating secured chat messaging between a first application module corresponding to a first user and a second application module corresponding to a second user on the first application module, the method comprising:

deriving a master password-based encryption key from a master password;

generating a data key;

encrypting the data key with the master password-based encryption key;

sending the encrypted data key to a first service provider vault corresponding to the first user;

generating a first key pair comprising a first public key and a first private key corresponding to the first user;

storing the first public key in the first service provider vault without encryption for the second client device to receive from the first service provider vault;



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receiving request to connect to a chat thread from a  
second application module corresponding to the second  
user where the second application module accesses the  
first public key corresponding to the first user from the  
first service provider vault and encrypts a record key 5  
for encrypting chat messages of a chat thread using the  
first public key;  
decrypting the first private key using the data key;  
decrypting the encrypted record key using the first private  
key; 10  
decrypting the chat messages in the chat thread using the  
record key; and  
sending the decrypted chat messages for display by the  
second application module corresponding to the second  
user. 15

**17.** The computer-implemented method of claim **16**, further comprising re-encrypting the record key with the data key to improve speed and performance.

\* \* \* \* \*

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